



# Reliability Analysis Update Immediate Need

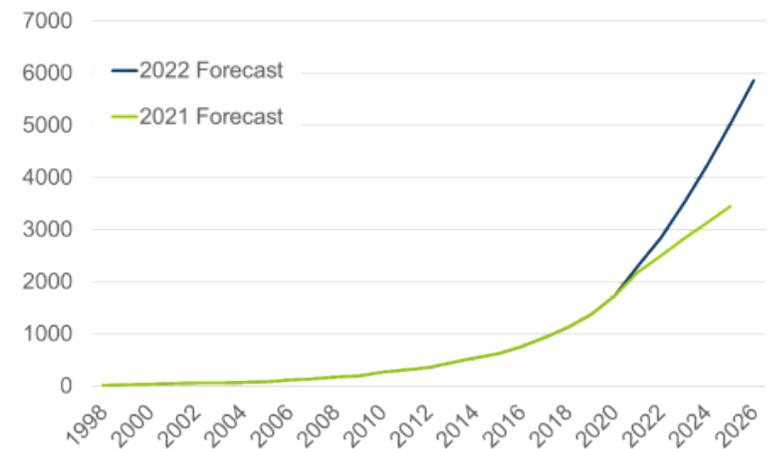
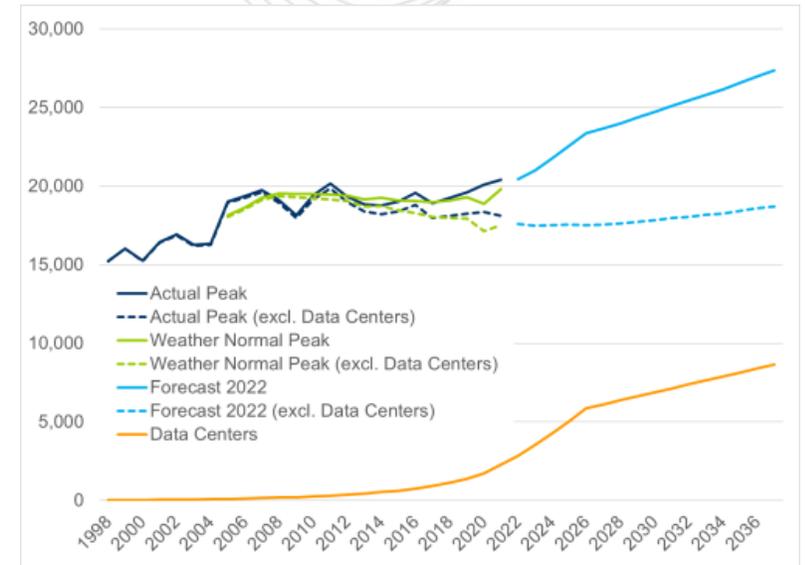
Sami Abdulsalam, Senior Manager

Transmission Expansion Advisory Committee  
September 6, 2022

# Second Review

## Baseline Reliability Projects

- At the June 7<sup>th</sup> TEAC, PJM presented information concerning the load growth that the Dominion area has been experiencing in the data center alley area around the Dulles airport.
- The data center loads reflect an annualized growth rate of 3%.
- Forecasted data center additions for the 2022 Load Forecast provided by Dominion and NOVEC were noticeably higher than in the prior year.
- At the July 12<sup>th</sup> TEAC, PJM indicated that due to the highly concentrated load growth in the data center alley area, numerous reliability violations were observed in the 2024 and 2025 timeframes despite planned supplemental and baseline upgrades.
- Without further transmission upgrades in the 2024/2025 timeframe, the area will not have sufficient transmission capability to serve the load.
- PJM announced an Immediate Transmission Development need (without a window) to serve the new load in the 2024/25 timeframe.



**Process Stage:** Second Review

**Criteria:** Summer N-1, GenDeliv, N-1-1 Thermal & 300 MW Load Loss

**Assumption Reference:** 2027 RTEP assumption

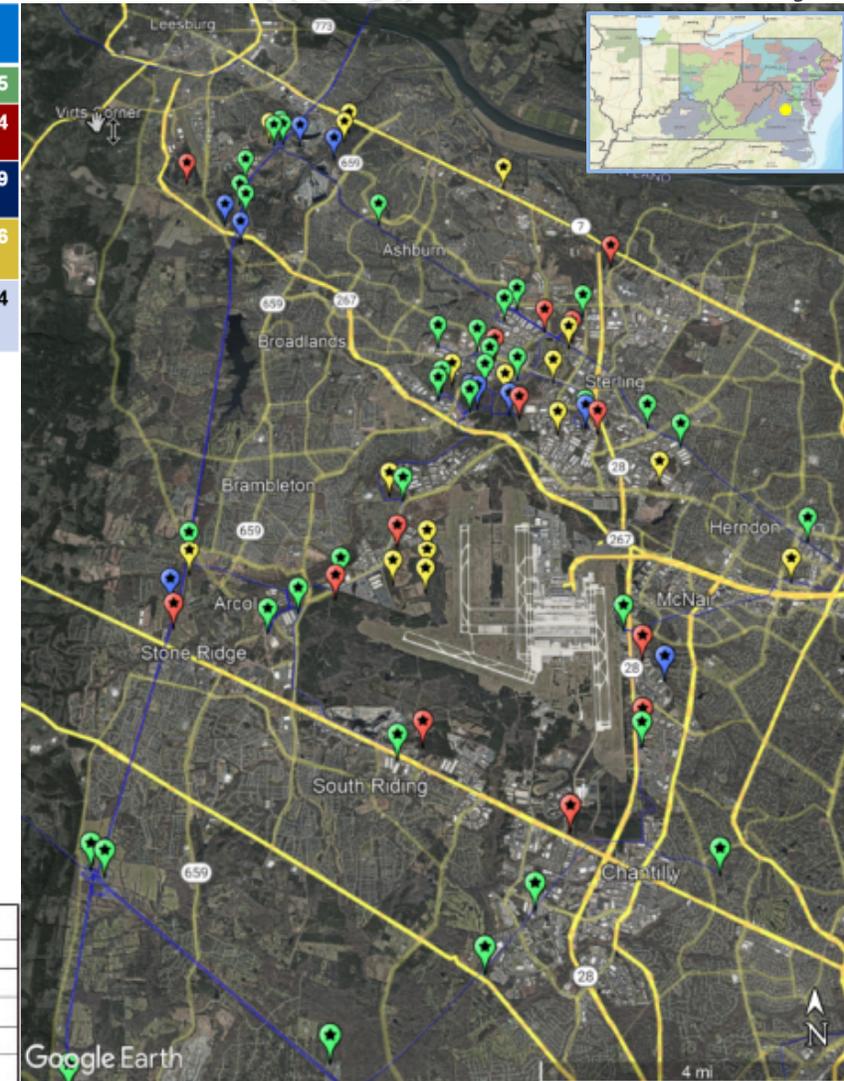
**Model Used for Analysis:** 2027 RTEP summer case

**Proposal Window Exclusion:** Immediate Need

**Problem Statement:**

- Various thermal issues and load loss in the Data Center Alley area around Dulles airport.
  - **N-1:** 2022W1-N1-ST16-18, 2022W1-N1-ST20, 2022W1-N1-ST23
  - **GenDeliv:** 2022W1-GD-S588, 2022W1-GD-S1028, 2022W1-GD-S622, 2022W1-GD-S35
  - **N-1-1:** 2022W1-N2-ST12-51
  - **N-1-1 Load Loss:** 2022W1-N2-SLD1, 2022W1-N2-SLD2

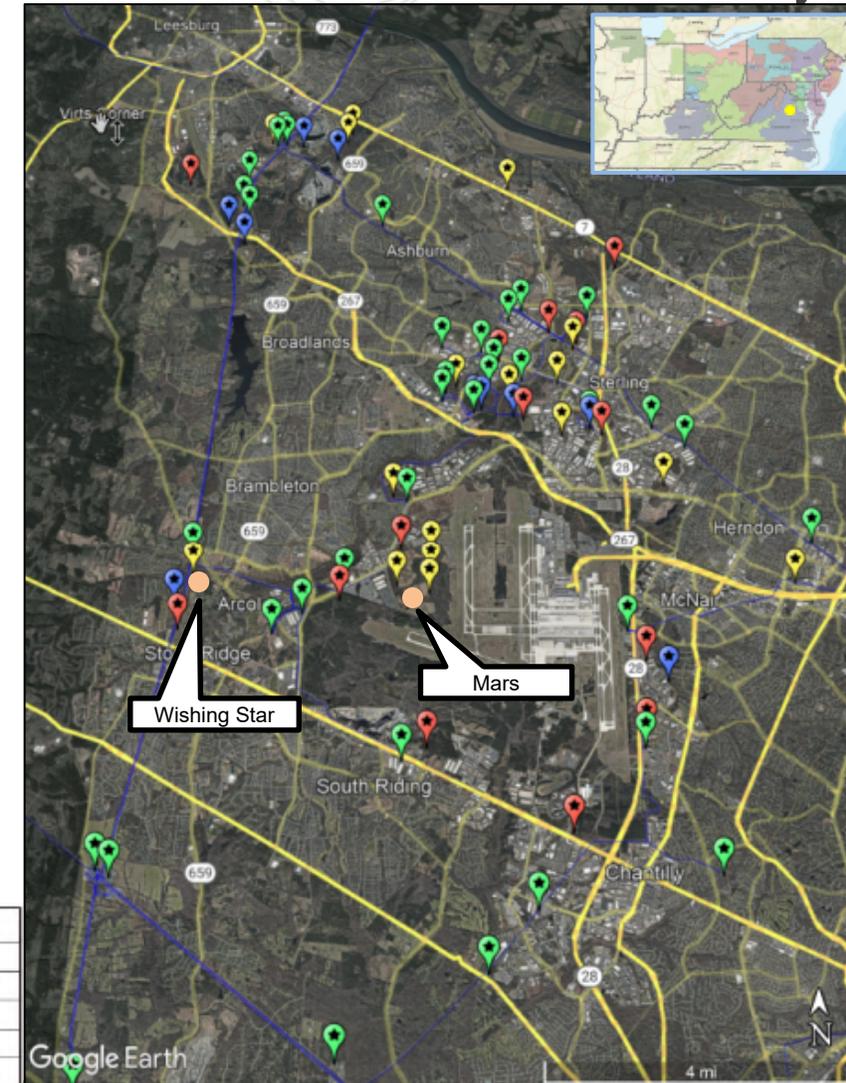
	Dominion Energy	NOVEC	Total
Existing	28	7	35
Design/Construction	11	3	14
In Planning Stage	6	3	9
Inquiry Stage	10	6	16
<b>Total</b>	<b>55</b>	<b>19</b>	<b>74</b>



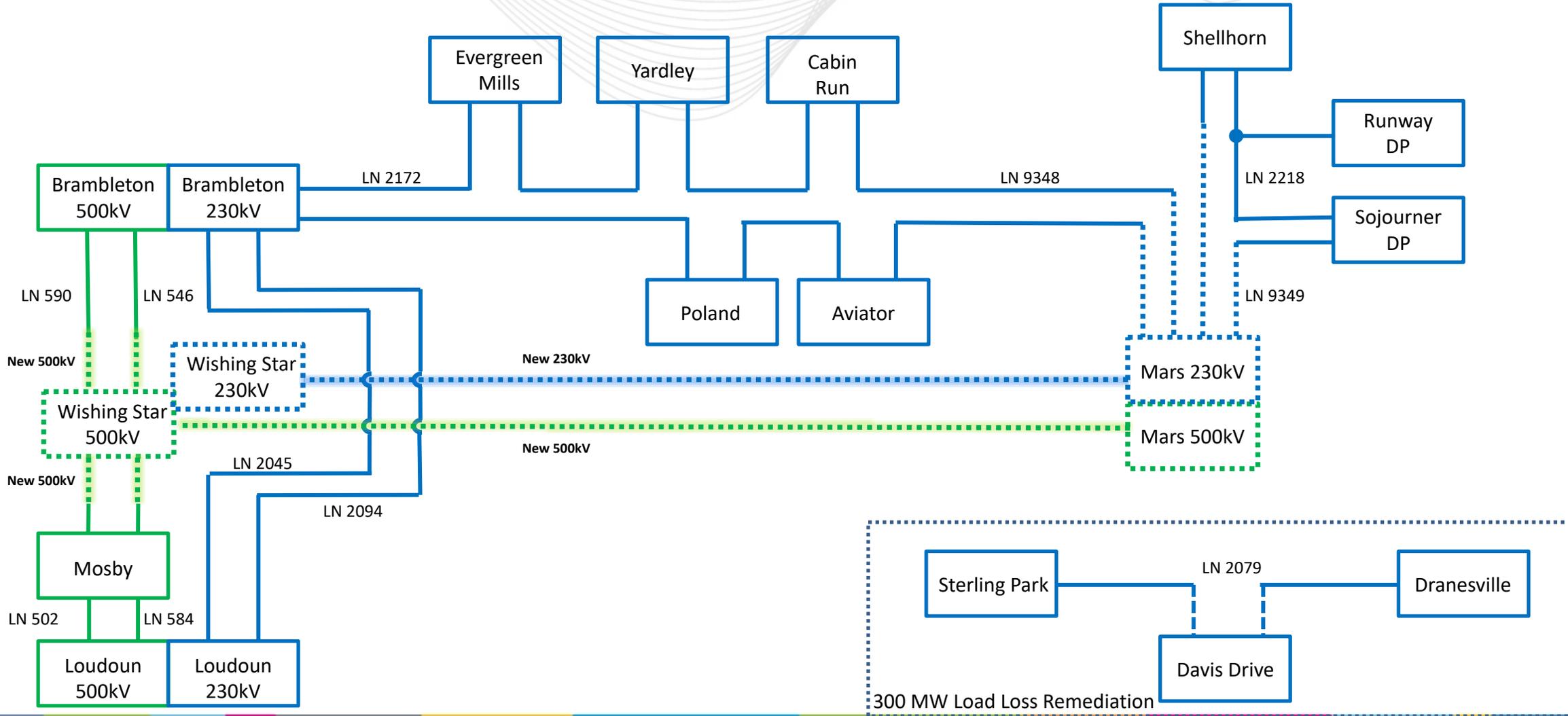
Continued on next slide...

## Recommended Solution: Option 3 (5-2, Wishing Star, 2 TXs)

- Build a new 500/230kV substation called Wishing Star near Brambleton substation.
- Cut and extend 500kV Line #546 (Brambleton-Mosby) and 500kV Line #590 (Brambleton-Mosby) to the proposed Wishing Star substation. Lines to terminate in a 500kV breaker and a half configuration.
- Install one 500/230kV 1440MVA transformer at Wishing Star substation.
- Build a new 500/230kV substation called Mars near Dulles International Airport.
- Construct double circuit 500kV and 230kV circuit transmission lines for approximately 3.5 miles from Wishing Star substation to Mars substation. New right-of-way will be needed for the transmission lines. New conductor to have a minimum summer normal rating of 4357MVA at 500kV and 1573MVA at 230kV.
- Install one 500/230kV 1440MVA transformer at Mars substation.
- ~~Upgrade 230kV bus to 4000A, 80 kA equipment at Brambleton substation~~
- ~~Replace (4) 230kV breakers at Loudoun substation~~
- Cut and loop 230kV Line #2079 (Sterling Park - Dranesville) into Davis Drive substation and install two GIS 230kV breakers. (Overlap with supplemental need DOM-2021-0032)



Continued on next slide...



## Recommended Solution: Option 3 (5-2, Wishing Star, 2 TXs)

Additional project scope required to clear capacity out of the new 500/230kV Wishing Star and Mars substations:

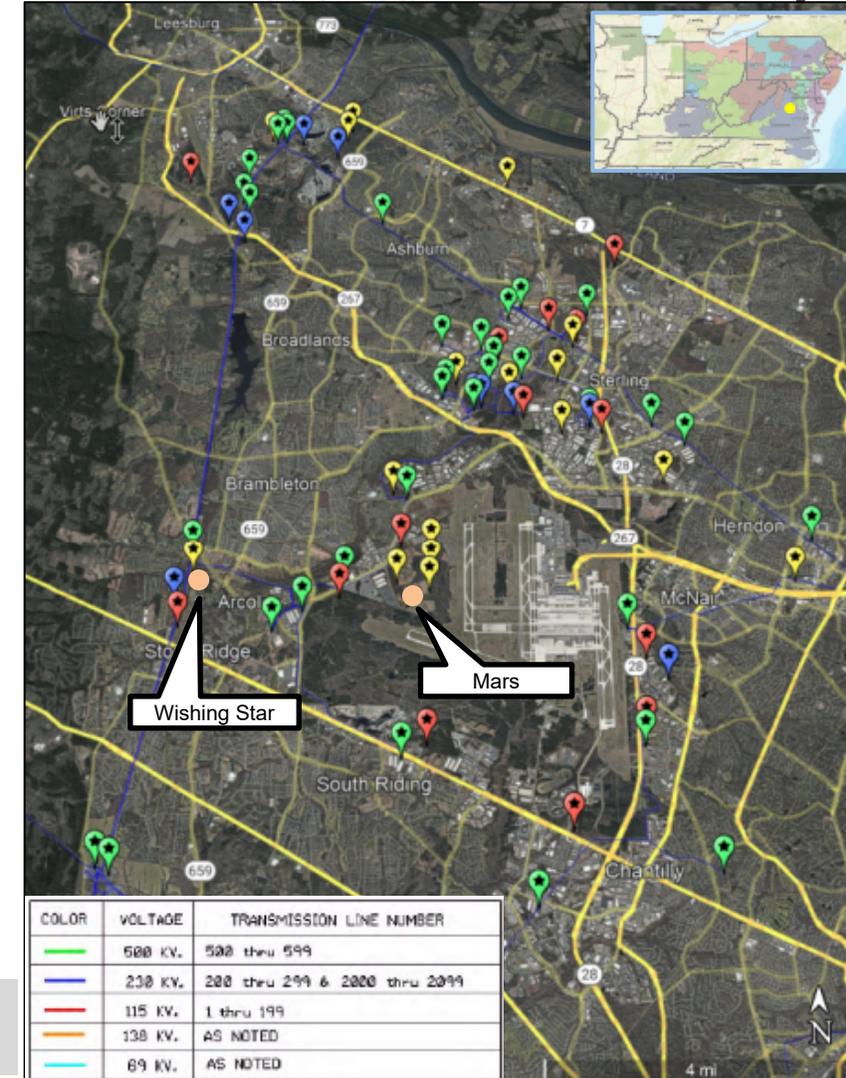
- Reconductor the following 230kV lines to achieve a summer rating of 1574 MVA:

230kV Line	Length (mi)	Existing Rating SN/SE/WN/WE (MVA)	Preliminary Rating SN/SE/WN/WE (MVA)
#2214 Buttermilk - Roundtable	0.62	1047/1047/1160/1160	1574/1574/1648/1648
#2031 Enterprise - Greenway - Roundtable	1.52	1047/1047/1160/1160	1574/1574/1648/1648
#2186 Enterprise - Shellhorn	0.64	1047/1047/1160/1160	1574/1574/1648/1648
#2188 Lockridge - Greenway - Shellhorn	2.17	1047/1047/1160/1160	1574/1574/1648/1648
#2223 Lockridge - Roundtable	0.84	1047/1047/1160/1160	1574/1574/1648/1648
#2218 Sojourner - Runway - Shellhorn	3.98	1047/1047/1160/1160	1574/1574/1648/1648
#9349 Sojourner - Mars	1.61	1047/1047/1160/1160	1574/1574/1648/1648

- Upgrade terminal equipment to remove the single element derates on the following 500kV lines:

500kV Line	Existing Rating (Derate) SE/SLD/WE/WLD (MVA)	Preliminary Rating SE/SLD/WE/WLD (MVA)
#584 Loudoun – Mosby Ckt 1	2858/3144/3403/3637	3967/4562/4832/5196
#502 Loudoun – Mosby Ckt 2	2809/2931/3403/3524	3967/4562/4832/5196

**SN / SE / SLD** : Summer Normal / Summer Emergency / Summer Load Dump  
**WN / WE / WLD**: Winter Normal / Winter Emergency / Winter Load Dump



Continued on next slide...



# Dominion Transmission Zone: Baseline Data Center Alley

**Total Estimated Cost: ~~\$603.0 M~~ \$627.62 M**

- Wishing Star substation: \$210.0 M<sup>(1)</sup> (b3718.1)
- Mars substation: \$197.0 M<sup>(1)</sup> (b3718.2)
- 500kV and 230kV line extensions: \$164.0 M<sup>(1)</sup> (b3718.3)
- ~~Brambleton substation upgrades: \$ 12.0 M~~
- ~~Loudoun breaker replacements: \$ 5.00 M~~
- 230kV Line #2214 Buttermilk – Roundtable reconductor: \$ 4.79 M (b3718.4)
- 230kV Line #2031 Enterprise - Greenway - Roundtable reconductor: \$ 5.89 M (b3718.5)
- 230kV Line #2186 Enterprise - Shellhorn reconductor: \$ 3.96 M (b3718.6)
- 230kV Line #2188 Lockridge - Greenway - Shellhorn reconductor: \$ 3.80 M (b3718.7)
- 230kV Line #2223 Lockridge - Roundtable reconductor: \$ 2.59 M (b3718.8)
- 230kV Line #2218 Sojourner - Runway - Shellhorn reconductor: \$ 6.51 M (b3718.9)
- 230kV Line #9349 Sojourner - Mars reconductor: \$ 1.43 M (b3718.10)
- 500kV Line #502 terminal equipment upgrades: \$ 6.27 M (b3718.11)
- 500kV Line #584 terminal equipment upgrades: \$ 6.38 M (b3718.12)
- 230kV Line #2079/Davis Drive upgrades: \$ 15.0 M (b3718.13)

**Projected In-Service: 6/1/2025**

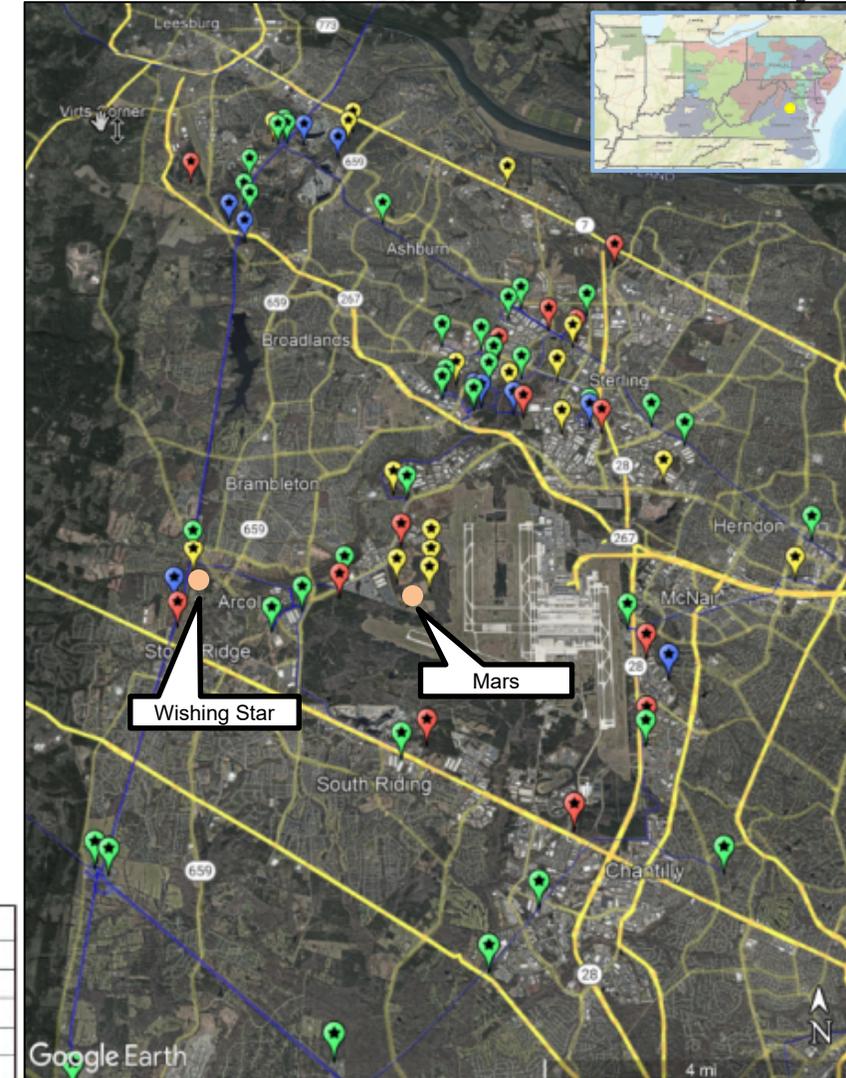
**Required In-Service: 6/1/2025**

**Previously Presented: 8/6/2022**

Continued on next slide...

(1) Total Risk/Contingency/Escalation Cost of \$92 M spread across project components.

COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
Green	500 KV.	500 thru 599
Blue	230 KV.	200 thru 299 & 2000 thru 2999
Red	115 KV.	1 thru 199
Orange	138 KV.	AS NOTED
Cyan	69 KV.	AS NOTED



## Alternatives:

- **Option 1 (Double Circuit 230 kV):** Build a new 500/230kV substation called Wishing Star. Cut and extend 500kV Line #546 and 500kV Line #590 to the proposed Wishing Star substation. Install two 500/230kV transformers at Wishing Star substation. Build a new 500/230kV substation called Mars. Construct double circuit 230kV – 230kV circuit transmission lines from Wishing Star substation to Mars substation. **Estimated Cost:** \$481.0 M
  - Option not selected due to limitations on transfer capability with 2x230kV feeds going into Mars substation to serve load.
- **Option 2 (5-2, Brambleton Option):** Build a new 500/230kV substation called Mars. Construct double circuit 500kV – 230kV circuit transmission lines from Brambleton substation to Mars substation. Install two 500/230kV transformers at Mars substation. **Estimated Cost:** \$416.0 M
  - Option not selected due to routing constraints out of Brambleton substation in addition to land limitations within and around Brambleton for substation expansion.
- **Option 4 (Line #546 & # 2094 Line Extensions):** Build a new 500/230kV substation called Mars. Remove 500kV Line #546 termination at Brambleton and extend line to Mars substation. Remove 230kV Line #2094 at Brambleton and extend line to Mars substation. Construct double circuit 500kV – 230kV circuit transmission lines from Brambleton substation to Mars substation. Install two 500/230kV transformers at Mars substation. **Estimated Cost:** \$393.0 M
  - Option not selected due to adverse impacts on north-south backbone capability (both 500kV and 230kV N-S corridor lines). Will also limit options to further reinforce system to accommodate future load growth.
- **Option 5 (Double Circuit 500kV-500kV):** Build a new 500/230kV substation called Mars. Construct double circuit 500kV – 500kV circuit transmission lines by cutting 500kV Line #546 and looping into Mars substation. Install two 500/230kV transformers at Mars substation. **Estimated Cost:** \$462.0 M
  - Option was not selected due to Right of Way limitations, crossing over 230kV lines coupled with FAA height restrictions around the Dulles airport.

Continued on next slide...

Facilitator:  
Sue Glatz,  
[Suzanne.Glatz@pjm.com](mailto:Suzanne.Glatz@pjm.com)

Secretary:  
Mike Zhang,  
[Michael.Zhang@pjm.com](mailto:Michael.Zhang@pjm.com)

SME/Presenter:  
Sami Abdulsalam,  
[Sami.Abdulsalam@pjm.com](mailto:Sami.Abdulsalam@pjm.com)

## Reliability Analysis Update



### Member Hotline

(610) 666 – 8980

(866) 400 – 8980

[custsvc@pjm.com](mailto:custsvc@pjm.com)

Version No.	Date	Description
1	8/29/2022	<ul style="list-style-type: none"><li>• Original slides posted</li></ul>

**PROTECT THE  
POWER GRID  
THINK BEFORE  
YOU CLICK!**



Be alert to  
malicious  
phishing emails.

**Report suspicious email activity to PJM.**  
(610) 666-2244 / [it\\_ops\\_ctr\\_shift@pjm.com](mailto:it_ops_ctr_shift@pjm.com)

